Listing of Claims

This listing of claims will replace all prior versions, and listings, of claims in the application:

Claim 1. (Currently Amended) A method for efficient QoS signaling for Mobile IP protocol using RSVP framework in which mobile nodes are connected to correspondent nodes via a plurality of intermediate nodes, comprising the steps of:

initiating in the mobile node a first PATH message for upstream data;

sending the first PATH message from the mobile node to the correspondent node via intermediate nodes;

initiating in the correspondent node a first RESV message for upstream data;

sending this RESV message from the correspondent node to the mobile node via the intermediate nodes;

thereafter sending REFRESH (periodic PATH and RESV) messages only between intermediate nodes;

initiating in the correspondent node a first PATH message for downstream data;

sending the first PATH message from the correspondent node to the mobile node via intermediate nodes;

initiating in the mobile node a first RESV message for downstream data;

sending the first RESV message from the mobile node to the correspondent node via the intermediate nodes; ~~and~~

thereafter sending REFRESH (periodic PATH and RESV) messages only between intermediate nodes;

handing over the mobile node from an old access router to a new access router; and

transferring, as part of the handover, PATH and RESV state block information from the old access router to the new access router, whereby an RSVP resource allocated to the mobile node prior to the handover is reused for the mobile node after the handover.

Claim 2. (Original) The method according to claim 1, wherein REFRESH messages are exchanged between the intermediate nodes, wherein the mobile node is attached to a first node of the intermediate nodes by a wireless link, and wherein subsequent REFRESH message do not traverse the wireless link.

Claim 3. (Original) The method according to claim 1, wherein the correspondent node is attached to a second node of the intermediate nodes by a further wireless link, and wherein subsequent REFRESH messages do not traverse the further wireless link.

Claim 4. (Original) The method according to claim 1, wherein the mobile node is attached to a first node of the intermediate nodes by a wireless link, and wherein initial PATH messages and initial RESV messages traverse the wireless link.

Claim 5. (Original) The method according to claim 1, wherein the correspondent node is attached to a second node of the intermediate nodes by a further wireless link, and wherein initial PATH messages and initial RESV messages traverse the further wireless link.

Claim 6. (Original) A method for efficient QoS signaling for Mobile IP protocol using RSVP framework in which mobile nodes are connected to correspondent nodes via a plurality of intermediate nodes, comprising the steps of:

initiating in the mobile node a first PATH message for upstream data;

sending the first PATH message from the mobile node to the correspondent node via intermediate nodes;

initiating in the correspondent node a first RESV message for upstream data;

sending the first RESV message from the correspondent node to the mobile node via the intermediate nodes;

forming a proxy REFRESH generation function for upstream data in a node that is close to the mobile node in the end-to-end packet path and a proxy REFRESH interception function for upstream data in a node that is close to the correspondent node in the end-to-end packet path, so that the REFRESH messages do not traverse the wireless links;

initiating in the correspondent node a first PATH message for downstream data;

sending the first PATH message from the correspondent node to the mobile node via intermediate nodes;

initiating in the mobile node a first RESV message for downstream data;

sending the first RESV message from the mobile node to the correspondent node via the intermediate nodes; and

forming a proxy REFRESH generation function for downstream data in a node that is close to the correspondent node in the end-to-end packet path and a proxy REFRESH interception function for downstream data in a node that is close to the mobile node in the end-to-end packet path, so that the REFRESH messages do not traverse the wireless links.

Claim 7. (Original) The method according to claim 6, wherein a proxy REFRESH generation function for upstream data generates PATH REFRESH messages on behalf of the mobile node.

Claim 8. (Original) The method according to claim 6, wherein a proxy REFRESH interception function for upstream data responds to the PATH REFRESH message by sending RESV REFRESH message on behalf of the correspondent node, if the latter is attached using the further wireless link; and

does not allow PATH REFRESH message to be transmitted over the further wireless link.

Claim 9. (Original) The method according to claim 6, wherein a proxy REFRESH generation function for downstream data generates PATH REFRESH messages on behalf of the correspondent node.

Claim 10. (Original) The method according to claim 6, wherein a proxy REFRESH interception function for downstream data responds to the PATH REFRESH message by sending RESV REFRESH message on behalf of the mobile node, if the latter is attached using the wireless link; and

does not allow PATH REFRESH message to be transmitted over the wireless link.

Claim 11. (Original) The method according to claim 1, wherein the method further comprises performing proactive RSVP signaling for upstream data at the time of handover of mobile node from one access router to another.

Claim 12. (Original) The method according to claim 1, wherein the method further comprises performing proactive RSVP signaling for downstream data at the time of handover of mobile node from one access router to another.

Claim 13. (Currently amended) The method according to claim 11, wherein the method further comprises the steps of:

~~transferring PATH state block and RESV state block for uplink data from an old access router to a new access router;~~

sending from the new access router the PATH message for the upstream data along ~~the~~ a new packet path; and

sending from the correspondent node the RESV message for the upstream data along the new packet path; and

intercepting this RESV message at the new access router.

Claim 14. (Original) The method according to claim 13, wherein the method further comprises informing the access router to which correspondent node is attached not to reserve any new link resources for the sent RESV message for upstream data.

Claim 15. (Currently amended) A method for efficient QoS signaling for Mobile IP protocol using RSVP framework in which mobile nodes are connected to correspondent nodes via a plurality of intermediate nodes, comprising the steps of:

initiating in the mobile node a first PATH message for upstream data;

sending the first PATH message from the mobile node to the correspondent node via intermediate nodes;

initiating in the correspondent node a first RESV message for upstream data;

sending this RESV message from the correspondent node to the mobile node via the intermediate nodes;

thereafter sending REFRESH (periodic PATH and RESV) messages for an upstream stream only between intermediate nodes;

initiating in the correspondent node a first PATH message for downstream data;

sending the first PATH message from the correspondent node to the mobile node via intermediate nodes;

initiating in the mobile node a first RESV message for downstream data;

sending the first RESV message from the mobile node to the correspondent node via the intermediate nodes;

thereafter sending REFRESH (periodic PATH and RESV) messages for a downstream stream only between intermediate nodes;

transferring PATH state block and RESV state block for uplink data from an old access router to a new access router;

sending from the new access router the PATH message for the upstream data along a new packet path;

sending from the correspondent node the RESV message for the upstream data along the new packet path;

intercepting this RESV message at the new access router;

informing the access router to which correspondent node is attached not to reserve any new link resources for the sent RESV message for upstream data,

~~The method according to claim 14,~~ wherein the correspondent node communicates with the access router using link-layer signaling to instruct it not to reserve any new link resources in response to the sent RESV, and instructing the access router to map the sent RESV to already allocated link resource for the mobile node's packet session, thereby avoiding double reservation on the wireless link.

Claim 16. (Original) The method according to claim 13, wherein the PATH state block and the RESV state block are modified before transferring to reflect a new care-of address of the mobile node.

Claim 17. (Original) The method according to claim 13, wherein fast handover protocol and context transfer protocol are used to transfer PATH and RESV state blocks for upstream data from the old access router to the new access router.

Claim 18. (Original) The method according to claim 12, wherein the method further comprises the steps of:

inferring at the correspondent node upon receiving the PATH message for upstream data from the new access router where mobile node is being handed off, about the impending handover of the mobile node using higher layer information;

sending the PATH message from the correspondent node for downstream data along the new packet path; and

intercepting this PATH message at the new access router; and

sending RESV from the new access router to the correspondent node for the downstream data along the new packet path.

Claim 19. (Original) The method according to claim 18, wherein the correspondent node upon receiving the PATH message for upstream data from the new access router, infers about the impending handover of the mobile node using the binding of transport layer (UDP or TCP) port with the application.

Claim 20. (Original) The method according to claim 13, wherein the method further comprises sending subsequent PATH REFRESH messages for the upstream data from the new access router along the new packet path on behalf of the mobile node.

Claim 21. (Original) The method according to claim 13, wherein the method further comprises the steps of:

intercepting at the access router to which correspondent node is attached, the subsequent PATH REFRESH messages for the upstream data arriving along the new packet path;

initiating at the access router to which correspondent node is attached, the subsequent RESV REFRESH messages for the upstream data; and

sending the RESV REFRESH messages along the new upstream packet path.

Claim 22. (Original) The method according to claim 13, wherein the method further comprises intercepting subsequent RESV REFRESH messages for the upstream data at the new access router so that they do not traverse the wireless link to which the mobile node is attached.

Claim 23. (Original) The method according to claim 18, wherein the method further comprises sending subsequent PATH REFRESH messages for the downstream data from the access router to which correspondent node is attached along the new packet path on behalf of the correspondent node.

Claim 24. (Original) The method according to claim 18, wherein the method further comprises intercepting subsequent RESV REFRESH messages for the downstream data at the access router to which correspondent node is attached so that they do not traverse the wireless link to which the correspondent node is attached.

Claim 25. (Currently amended) The method according to claim 13, wherein the method further comprises the steps of:

comparing at the new access router, the RESV message for upstream data with the transferred RESV state block from the old access router; and

informing the ~~result to the~~ mobile node of the result.

Claim 26. (Original) The method according to claim 25, wherein the method further comprises deciding at the mobile node whether to continue the packet session in case the required resource is not available along the new packet path.

Claim 27. (Original) The method according to claim 26, wherein the method further comprises tearing down the packet session if the resource availability along the new packet path is not acceptable to the mobile node.

Claim 28. (Original) The method according to claim 26, wherein the method further comprises adapting the mobile node's application to the resource availability along the new packet path.

Claim 29. (Original) The method according to claim 6, wherein the method further comprises using a flow ID number in RSVP messaging to identify packet flow.

Claim 30. (Original) The method according to claim 29, wherein the flow ID number is calculated by hashing a known block of data with user specific key.

Claim 31. (Original) The method according to claim 30, wherein the user specific key is chosen by a user, and is at least one of a password or a pet word.

Claim 32. (Original) The method according to claim 29, wherein the method further comprises mapping multiple RSVP FILTER_SPECs to a resource that is identified by the flow ID number.